SILIGURI INSTITUTE OF TECHNOLOGY

COMPUTER SCIENCE & ENGINEERING

COURSE FILE

1ST SEM, 2ND YEAR, 2015

PAPER NAME: DATA STRUCTURE AND ALGORITHM

PAPER CODE : CS 302 & CS 392

Course Title/Code: Data Structure and Algorithm/CS302 & CS392

Semester:-1st Year:- 2nd Group:- B

Name of the Faculty: Prof. Sutapa Bhattacharya
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Class Schedule:

Day	Monday	Tuesday [2L]	Wednesday[L]	Thursday	Friday [T]
Timing(B)	---	11:40 am – 1:20pm	11:40 am – 12:30pm	---	2:10 pm – 3:00 pm

Laboratory Schedule:

Day	Monday	Tuesday	Wednesday	Thursday	Friday
Group B1	---	---	---	2:10 pm – 4:40 pm	---
Group B2	---	2:10 pm – 4:40 pm	---	---	---

Hours of Meeting Students:

Day	Monday	Tuesday	Wednesday	Thursday	Friday
Timing(B)	3.50pm--4.50pm	3.50pm--4.50pm	3.50pm--4.50pm	3.50pm--4.50pm	3.50pm--4.50pm

- OR Byappointment.

i) Course Objective:

Students will be capable to demonstrate the basic concept of data structures and implement it through C programming language and compute asymptotic notations of an algorithm to analyze the consumption of resources (time/space).

ii) Course Outcomes:

After completion of this course the students are expected to be able to demonstrate following Knowledge, skills and attitudes.

a) The Students will be able to:

COs	Outcomes	Targets
CS302.1	1. **Describe** ideas about Algorithm and basic data structures. **(BT-LEVEL 2)**	60% marks
CS302.2	**2. Implement** linear data Structure like array, linked list and its operations. **(BT- LEVEL 3)**	60% marks
CS302.3	**3. Solve** the different problems on stack, queue and recursive techniques.**(BT-LEVEL 3)**	60% marks
CS302.4	**4. Utilize** the knowledge about the basic data structure and algorithm in non- linear data structures.**(BT-LEVEL 3)**	60% marks
CS302.5	**5. Verify** the complexity of standard algorithms for Sorting, Searching and Hashing. **(BT-LEVEL 5)**	60% marks

b) Once the student has successfully complete this course, he/she must be able to answer the following questions or perform/demonstrate the following:

SN	QUESTION	BT- LEVEL
1.	**Define**linear and non-linear data structure.	2
2.	**Describe** briefly about asymptotic notations.	2
3.	How do you **implement**thelinked list data structure?	3
4.	How to **solve** the problem of singly linked list?	3
5.	How do you **implement**stack using array and linked list?	3
6.	How do you **implement**linear queue using array and linked list?	3
7.	How do you **implement**linear queue using array and linked list?	3
8.	How to **calculate** Balance factor in AVL tree?	3
9.	How can implement a non-linear data structure?	3
10.	What is the technique to **detect** worst time complexity in quick sort?	5
11.	How to **verify** complexity of sorting algorithm**?**	5

Data Structure and Algorithm Syllabus [in Units]
Paper Code: CS302
Contracts: 3L + 1 T
Credits- 4

Unit -1: Introduction (2L)
Why we need data structure?
Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type. Algorithms and programs, basic idea of pseudo-code.
Algorithm efficiency and analysis, time and space analysis of algorithms – order notations.

Unit-2: Array (2L)
Different representations – row major, column major.
Sparse matrix - its implementation and usage.Array representation of polynomials.

Unit-3: Linked List (4L)
Singly linked list, circular linked list, doubly linked list, linked list representation of polynomial and applications.

Unit-4: Stack and Queue (5L)
Stack and its implementations (using array, using linked list), applications.
Queues, circular queue, dequeue. Implementation of queue- both linear and circular (using array, using linked list), applications.

Unit-5: Recursion (2L)
Principles of recursion – use of stack, differences between recursion and iteration, tail recursion. Applications - The Tower of Hanoi, Eight Queens Puzzle.

Unit-6: Nonlinear Data structures Trees (9L)
Basic terminologies, forest, tree representation (using array, using linked list).
Binary trees-binary tree traversal (pre-,in-,post-order),threaded binary tree(left,right,full)-non-recursive traversal algorithms using threaded binary tree, expression tree.
Binary search tree- operations (creation, insertion, deletion, searching).
Height balanced binary tree – AVL tree (insertion, deletion with examples only). B-Trees – operations (insertion, deletion with examples only).

Unit-7: Nonlinear Data structures Trees Graphs (6L):
Graph definitions and concepts (directed/undirected graph, weighted/un-weighted edges, sub-graph, degree, cut- vertex/articulation point, pendant node, clique, complete graph, connected components – strongly connected component, weakly connected component, path, shortest path, isomorphism).
Graph representations/storage implementations – adjacency matrix, adjacency list, adjacency multi-list.
Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS) – concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, and forward-edge), applications.
Minimal spanning tree – Prim's algorithm (basic idea of greedy methods).

Unit -8: Sorting (5L)
Bubble sort and its optimizations, insertion sort, shell sort, selection sort, merge sort, quicksort, heap sort (concept of max heap, application – priority queue), radix sort.

Unit -9: Searching (2L)
Sequential search, binary search, interpolation search.

Unit -10: Hashing (3L)
Hashing functions, collision resolution techniques.

c) Unit Layout

Unit No.	Unit	Lecture Hours	Tutorials	Laboratory Hours
1	Introduction	2HRS		
2	Array	2 HRS	1	3 HRS
3	Linked List	4 HRS	1	12 HRS
4	Stack and Queue	5 HRS	2	6 HRS
5	Recursion	2 HRS	1	3 HRS
6	Trees	9 HRS	2	3 HRS
7	Graphs	6 HRS	2	

8	Sorting	5 HRS	1	6 HRS
9	Searching	2 HRS	1	3 HRS
10	Hashing	3 HRS	1	
	Total	**40**	**12**	**36HRS**

Text Books:

1) Data Structure and Algorithms , Seymour Lipschutz, TMH Publications

2) Data Structures using C and C++ by Langsam, Tenenbaum, PHI publications

Reference Books:

1) "Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed

2) Data structures through C language by Samiran Chattopadhyay

d) Evaluation Scheme:

1) Theory:

Evaluation Criteria	Marks
First& Second Internal Exam*	15
Assignments/Quiz	10
Attendance	5
University Exam	70
Total	100

* Two internal examinations are conducted; based on those two tests, average of them are considered in a scale of 15.

University Grading System:

Grade	Marks
O	90% and above
E	80– 89.9%
A	70– 79.9%
B	60– 69.9%
C	50– 59.9%
D	40– 49.9%
F	Below 40%

2) Practical:

Evaluation Criteria	Marks
Internal Exam*	40
University Exam	60
Total	100

*Internal Evaluation will be based on daily lab performance as per the following schedule:

e) Laboratory Evaluation:

Experiment No.	Experiment Name	Schedule	Marks
P1	Implement the following Operation of Array data structure: 1) Insertanddeleteanelementintoan Array. 2) Traverse thearray.	3 HRS	3
P2	Implement the following Operation of Single linked list : 1) Create and Traverse a single linked list. 2) Insertanddeleteanelementfromalist 3) Reverse a single list. 4) Searching the element from the list 5)Sorting the node values in ascending order	3 HRS	4
P3	1) Implement The following Stack Operation using Array and Linked List : a)PUSH() b)POP() c) Traversal 2)Write a program to implement Tower of Hanoi and 8queen puzzle problem using recursion	3 HRS	4
P4	1)Implement The following linear Queue Operation using Array and Linked list: a)Enqueue() b)Dequeue() c)Traversal 2)Implement The following Circular Queue Operation using Array : a)Enqueue() b)Dequeue() c) Traversal	3 HRS	4

P5	Implement The following Double ended Queue Operation using Array : a)Insert left() b)Insert right() c) Delete left() d) Delete right() e)Traversal()	3 HRS	4
P6	Implement the following Operation of Double linked list : 1) CreateandTraverseadoublelinkedlist. 2) Insertanddeleteanelementfromalist.	3 HRS	3
P7	Implement the following Operation of Circular linked list : 1) CreateandTraverseadoublelinkedlist. 2) Insertanddeleteanelementfromalist.	3 HRS	3
P8	Write a program to implement polynomial additionand multiplicationusinglinkedlist.	3 HRS	3
P9	Implement The following Binary search Tree operation : a) Insert an element b) Delete an element c) Search an element	3 HRS	3
P10	Develop the following sorting algorithm: a)Bubblesort b)Selectionsort c)InsertionSort d)Merge sort	3 HRS	3
P11	Develop the following sorting algorithm: a)Quick sort b)Heap sort c)Shell sort	3 HRS	3
P12	Develop the following searching algorithm: Linear Search, Binary Search and Interpolation search	3 HRS	3
Total			40
		University Exams	60

f) Overall Course Attainment Target

Attainment Level	Inference	Marks
Attainment Level 1	40%ofthestudentshaveattainedmorethanthetargetlevelofthatCO	1
Attainment Level 2	50%ofthestudentshaveattainedmorethanthetargetlevelofthatCO	2
Attainment Level 3	60%ofthestudentshaveattainedmorethanthetargetlevelofthatCO	3

Overall Course Attainment Target

(70% of university and 30% of the internal exam) will be = **Attainment Level 3**

Target has been set on the basis of last year's performance / result by the students, student quality this year and difficulty level of the course.

g)Mapping of Course Outcomes and Program Outcomes:

Course Outcomes	Program Outcomes												PSOs	
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	1.	2.
CS302.1	1	1	--	--	--	--	--	--	--	--	--	--	1	1
CS302.2	2	2	--	--	1	--	--	--	2	--	--	--	1	1
CS302.3	2	2	--	--	2	--	--	--	2	--	--	1	1	--
CS302.4	2	2	--	--	2	--	--	--	2	--	--	1	1	--
CS302.5	2	3	--	--	2	--	--	--	2	--	--	1	1	--
CS302	**2**	**2**	--	--	**2**	--	--	--	**2**	--	--	**1**	**1**	**1**

- CO1 to CO5 satisfies application of knowledge of mathematics and science in solving engineering problems and problem analysis. (PO1, PO2).
- CO2 to CO5 partially satisfies modern engineering and IT tools. (PO5).
- CO2 to CO5 minimally satisfies the individual and team work. (PO9).
- CO3 to CO5 minimally satisfies the lifelong learning. (PO12).
- CO1 to CO5 satisfies application of knowledge of mathematical foundations, programming skills and algorithm etc.(PSO1).
- CO1 and CO2 minimally satisfies PSO2

h) Delivery Methodology:

Outcome	Method	Supporting Tools	Demonstration
CS 302.1	Structured, Partially Supervised	Black Board ,NPTEL videos	Describe the basic algorithm and asymptotic notations.
CS 302.2	Structured, Partially Supervised	Black Board, C programming	Describe the different types of linked list and their implementations.
CS 302.3	Structured, Partial Supervised	Black Board, C programming	Demonstrate applications of stack and queue.

CS 302.4	Structured, Partial Supervised	Black Board, C programming, Power point slides	Implement Non-linear data structures using linear data structures.
CS 302.5	Structured, Partial Supervised	Black Board, C programming, Power point slides	Implement different types of sorting, searching problems.

i) Assessment Methodology:

Assessment Tool	**Outcomes**					**Specific Question aligned to the Outcome**
	CS302.1	**CS02.2**	**CS302.3**	**CS302.4**	**CS302.5**	
FIRST INTERNAL	√	√	√	√	--	Write an algorithm to reverse a linked list in reverse order.
SECOND INTERNAL	--	--	--	√	√	Draw a max heap from the below list:12,11,7,3,5,9,2,10
ASSIGNMENT	√	--	√	√	√	Translating the following infix expression into postfix expression using algorithm: A+(B*C-(D/(E+F))*G)*H
QUIZ	√	√	√	√	√	…… function of C is used to allocate a block of memory. a)malloc() b)calloc() c)free() d)realloc()
LABORATORY	---	√	√	√	√	Write a program to implement singly linked list.

A. Weekly Lesson Plan

Week	Lectures	Tutorial	Laboratory	Assignment/Quiz
1	Discussion on course outcome and program outcome **Introduction:** Remembering C programming language. Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type. Algorithms and programs, basic idea of pseudo- code. **Linear Data Structure: Array-** Insertion, Deletion, Traversing, row major, column major, Sparse matrix - its implementation and usage **Linear Data Structure: Singly Linked List-** Definitions, Operations- Create, Traverse, Insertion	Review of C Language	Implement C programming using function and structure technique.	**Quiz1**
2	**Linear Data Structure: Singly Linked List-** Deletion, Reverse, Traverse(in reverse order),Sorting, Searching **Linear Data Structure: Stack-**Definitions, operations (push, pop, traverse). Implementations stack using array and linked list, Polish notations	Array	Array(P1)	**Assignment1**
3	Conversion -infix to postfix, Evaluation of postfix **Principles of recursion** – use of stack, differences between recursion and iteration, tail recursion, Applications - The Tower of Hanoi, Eight Queen puzzle problem **Linear queue -**(Definition, implementation using array and Linked List)	Single Linked List	Singly Linked list(P2)	**Assignment1**

4	**Circular queue**-(Definition, implementation using array and Linked List) **Double Ended queue**-(Definition, implementation using array)	Stack & Recursion	Stack & Recursion (P3)	**Assignment1**
5	Doubly Linked List –Definitions and operations(create, traverse, insertion, deletion Circular Linked List –Definitions and operations(create,traverse,insertion,deletion)	Queue	Queue (P4 & P5)	
6	Polynomial and Applications using array and linked list **Nonlinear Data structures- Trees :**Basic terminologies, forest, tree representation (using array and linked list),Binary trees - binary tree traversal (pre-, in-, post- order) Binary search tree-Definition and operations (create, insert,traverse,search),BSTdeletion	Double and Circular Linked List	Double and Circular Linked List(P6&P7)	**Assignment1**
7	Expression tree, Threaded binary tree (left, right, full) - non-recursive traversal algorithms using threaded binary tree Height balanced binary tree – AVL tree (insertion, deletion with examples only). B- Trees – operations (insertion, deletion with examples only). Basic idea of pseudo-code, Algorithm efficiency and analysis, time and space analysis of algorithms – order notations	Binary search tree	Polynomial addition and multiplication using linked list(P8)	**Assignment2**

8	**Sorting Algorithms :** Bubble sort and its optimizations, Insertion sort and analysis of time complexity Selection sort, Merge sort and analysis of time complexity Quick sort, Shell sort and analysis of time complexity Heap sort (concept of max heap), Radix sort and analysis of time complexity	B –Tree & AVL Tree	Binary search tree (P9)	**Assignment2**
9	**Searching :** Sequential , Binary search, Interpolation searchand its time complexity **Non-linear Data structure: Graphs-** definitions and concepts (directed/undirected graph, weighted/un-weighted edges, sub-graph, degree, cut-vertex/articulation point, pendant node, clique, and complete graph)	Asymptotic notations and Sorting Algorithms	Sorting(P10)	**Assignment2**
10	**Graphs:** Definitions (connected components – strongly connected component, weakly connected component, path, shortest path, isomorphism) Graph representations storage implementations – adjacency matrix, adjacency list, adjacency multi-list., connectivity – Depth-first search (DFS),	Searching	Sorting(P11)	**Assignment2**
11	Breadth-first search (BFS) – concepts of edges used in DFS and BFS, applications. Minimal spanning tree – Prim's algorithm (basic idea of greedy methods). **Hashing :** Hashing functions, collision resolution techniques	Graphs	Searching(P12)	
12	Discussion on Previous Question Paper on WBUT Revision Lesson	Hashing		

B. Daily Lesson Plan (Repeat format for each unit)

UNIT: 1

Title : Introduction

Date: 14/07/15 Day: Tuesday(11.40 a.m—13.20 p.m)

CONTENTS

1)Discussion on program outcome ,Introduction to C programming language with example 2)Define the Data structure

3) Classify Data Structure

4) Explain Algorithm with example

Unit Objectives: Student can able to recall C programming. Broad

Objectives of the unit are:

1. Concepts of using pointer function and structure.

2. Data structure definition and classifications.

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy):

1. **Describe** function, structure? (Level 2)
2. What do you **understand** by Data Structure? (Level 2)
3. **Classify** data structure with examples. (Level 5)
4. **Describe** characteristics of algorithms. (Level 2)
5. **Compare** between linear and non linear data structure. (Level 4)

HOME WORK: related to Topic objective and outcome as expressed in terms of indicators/criteria

1. What is the utilization of the following program? main()

```
{
        int a[]={0,1,2,3,4};
        int k, *p;
        for(p=a, k=0;p+k<=a+4; p++, k++) printf(" %d " ,
        *(p+k));

}
```

QUIZ: related to Topic objective and outcome (new quiz with real world examples) 1)…… function of C is used to allocate a block of memory.

a)malloc() b)calloc()

c)free() d)realloc()

UNIT: 2

Title :**Array and Its Operation**

Date: 15/07/15 Day: Wednesday(11.40a.m---12.30 p.m)

CONTENTS

1) Define Array data structure.

2) Insert an element in to Array.

3) Delete an element from Array.

4) Memory representation: row major and column major

Topic/Unit/Chapter Objectives: Student can able to understand about linear data structure. Broad Objectives of the chapter/topic are:

1. Concepts of linear data structure.

2. Implementthe algorithm to insert and deletean element from array.

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy):

1. **Describe** array? (Level1)

2. **Explain**thealgorithmforinsertanddeleteoperationonarraydatastructure.(Level4) 3.**Explain**with example on row major and column major. (Level 4)

HOMEWORK: related to Topic objective and outcome as expressed in terms of indicators/criteria

1) Let A be a two dimensional array declared as A[1….10][1….15] of integer. Assuming that each integer takes one memory locations the array is stored in row major order and the first element of the array is stored at location 100, what is the address of the element A[i][j]?

QUIZ: related to Topic objective and outcome (new quiz with real world examples)

1) Thenumberofelementsniscalledthelength ---------- of thearray.
a) UpperBound c) LowerBound
b) Size d)Variable

2) Arrays are best data structures
a) for relatively permanent collections of data b) for the size of the structure and the data in the

c) for both of above situation structure are constantly changing d) for none of above situation
LABORATORY EXPERIMENT: related to the Topic objective and outcome 1) Insert one element into array and delete one element from array.

UNIT: 2 Title :Tutorial I Date: 17/07/15 Day: Friday(02.10 p.m---03.00p.m)
CONTENTS 1) Write a C program to merge two arrays. 2) What is the difference between linear and non-linear data structure?

UNIT: 3 Title:**SingleLinked List** Date: 21/07/15 Day: Tuesday(11.40 a.m—13.20 p.m)
1) Definition of Linked list and its types. 2) Representation of linked list. 3) Operationsof Single Linkedlist(Create,Traverse,Insertion)
Unit Objectives: Student can able to understand about single linked list. Broad Objectives of the chapter/topic are: 1. Student can able to **understand** linked list. (Level 2) 2. How to **create** a single linked list? (Level 6) 3. **Compare** between array and linked list. (Level 4)
Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy): 1. **Explain** an algorithm for Creation of single linked list. (Level 4) 2.**Explain** the algorithm of Traversal of single linked list.(Level 4)

HOMEWORK: related to Topic objective and outcome as expressed in terms of indicators/criteria

1. Draw a single link list which has 5 nodes.

LABORATORY EXPERIMENT: related to the Topic objective and outcome

1) Implement the following operation of linked list a)Create list
b)Traversal

c)Insert first d)insert last e)Insert Anywhere

UNIT: 3

Title: **Single Linked List**

Date: 22/07/15 Day: Wednesday(11.40 a.m—12.30 p.m)

CONTENTS

Operations of Single Linked list.(Deletion,Searching,Sorting, Reversing)

Unit Objectives: Student can able to **understand** about operation of single linked list Broad Objectives

of the chapter/topic are:

1. Student can able to **understand** single linked list. (Level 2)
2. How to **explain** the algorithm to Insert and Delete an element from a single linked list? (Level 4)

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy):

1. **Explain** an algorithm for Insertion and deletion of single linked list. (Level 4)
2. **Explain** the algorithm of searching the element from single linked list. (Level 4)
3. **Explain** an algorithm for Sorting of single linked list. (Level 4)
4. **Explain** to Reverse single linked list. (Level 4)
5. **Explain** to traverse linked list in reverse order. (Level 4)

HOMEWORK: related to Topic objective and outcome as expressed in terms of indicators/criteria

1. Write an algorithm of finding the middle node form a single linked list.
2. Binary search is possible or not to find a node from a linked list.

LABORATORY EXPERIMENT: related to the Topic objective and outcome.

1) Implement the following operation of single linked list a)Delete first
b)delete last c)Delete anywhere

d)Sorting e)Reversing f)Traverse(in reverse order)

g)Search the element from list

UNIT: 3

Title:Tutorial-II

Date: 24/07/15 Day: Friday(02.10 a.m—03.00 p.m)

CONTENTS

1) What is the difference between array and linked list?
2) Find the middle element from a single link list without counting the number of node?
(If number of node is ODD then one middle element, if EVEN then two middle element)

3) Isitpossibletofind(searching)anodefromasinglelinklistusingBINARYsearch(considerallthe element in sorted order)

UNIT:3

Title : Linear Data Structure(Stack) Date:

28/07/15 Day:Tuesday

CONTENTS

1)STACK-Definitions, operations 3)Implementations

using array 4)Implementations using linked list

5)Application ofStack

6)Arithmetic notation(prefix, postfix, infix)

UnitObjectives:Studentcanabletoo**understand** aboutoperationofstack Broad

Objectives of the chapter/topic are:

1. Able to **understand** about Stack Data Structure
2. Student can able to **understand** stack operation (PUSH and POP)
3. Able to understand about how to represent prefix, postfix, and infix notation

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy):

1. What do you **understand** by push and pop operation in Stack? (Level 2)
2. **Finding** the over flow and under flow condition for Stack? (Level 4)
3. **Explaining** the real life example of stack? (Level 4)

HOMEWORK: related to Topic objective and outcome as expressed in terms of indicators/criteria

1. A single array A[1….MAXSIZE] is used to implement stacks. Two stacks grow from opposite ends of the array. Variable Top1 and Top2 (Top1<Top2) point to the location of the top most element in each stacks. if the space is to be used efficiently. so what is the STACK FULL condition?

QUIZ: related to Topic objective and outcome (new quiz with real world examples)

1. Stack is also called as
   a) Last in first out
   b) First in last out
   c) Last in last out
   d) First in first out

2. Inserting an item into the stack when stack is not full is called.....Operation and deletion of item form the stack, when stack is not empty is called..... operation.
   a) push, pop
   b) pop, push
   c) insert, delete
   d) delete, insert

LABORATORY EXPERIMENT: related to the Topic objective and outcome.

1. Implement Stack Operation in C programming language using array and linked list.

UNIT: 4

Title : Linear Data Structure(STACK) Date:

29/07/15 Day: Wednesday

CONTENTS

3)Convert infix to post fix expression(with examples)

4)Evaluation of post fix expression
Topic/Unit/Chapter Objectives: Student can able to understand stack data structure Broad Objectives of the chapter/topic are: 1. Student can able to understand how to convert infix to post fix expression 2. Student can able to understand how to evaluate post fix expression
Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy): 1. **Describe** polish notation? (Level 2) 2. What do you **understand** by reverse polish notation? (Level 2)
HOMEWORK: related to Topic objective and outcome as expressed in terms of indicators/criteria 1. Translating the following infix expression into post fix expression A+(B*C – (D/(E+F))*G)*H 2. Evaluate the following Post fix expression(with single digit operand). 8 2 3 ^ / 2 3 * + 5 1 * - Identify the Top two elements of the stack after the first * (operator) is evaluated.

UNIT: 4 Title :Tutorial-III Date: 31/07/15 Day: Friday
CONTENTS
1. Convert the following arithmetic expression infix to post fix expression i)A+B*D+(G-H) ii)F/G*(M*N+A) 2. Evaluate the following post fix expression. i)*+7 9-4 6 ii) /+2 4*-6 3 1 3. The following sequence of operation is perform on a stack : push(1),push(2),pop(),push(5),pop(),pop(),push(4),pop(). What are sequence of popped out values?

UNIT: 5

Title : Recursion

Date: 04/08/15 Day: Tuesday

CONTENTS

1) Recursion.

2) Types of Recursion.

3) Tower of Hanoi.

4) Eight Queen Puzzle Problem.

Unit Objectives: Student can able to **understand** about recursion and its classification. Broad Objectives of the chapter/topic are:

1. Student can able to understand How to apply recursion technique in real life application.
2. Student can able to understand how to draw recursive tree.

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy):

1. **Compare** between Recursion Vs Iteration. (Level 4)

2. **Describe** Tail recursion? (Level 2)

1. **Explain** the algorithm of Tower of Hanoi. (Level 4) 2.**Outline** a recursive Tree for Tower of Hanoi for n = 3. (Level 4)

3. **Explain** the algorithm of 8 queen puzzle problem. (Level 4)

HOME WORK: related to Topic objective and outcome as expressed in terms of indicators/criteria

1) int ABC(int n , int m)
{

if(n==0) return(m+1);

else if(m==0&&n>0)

return ABC(n-1,1);

else return ABC(n-1,ABC(n,m-1));

}

2) Draw a recursive Tree for Tower of Hanoi for n =4

QUIZ: related to Topic objective and outcome (new quiz with real world examples)

NA

LABORATORY EXPERIMENT: related to the Topic objective and outcome

1. Construct C programming language for GCD of two number recursive techniques.
2. Construct C programming language for Fibonacci series of two number using recursion.
3. Construct C programming language for tower of Hanoi in recursive technique.
4. Construct C programming language for eight queen puzzle problem in recursive technique.

UNIT: 4

Title: Linear Data Structure (Linear QUEUE) Date:

05/08/15 Day: Wednesday

CONTENTS

1) Linear Queue-Definitions

2) Operation of Queue (insert at front, delete at rear)

3)Implementation using array and linked list

Topic/Unit/Chapter Objectives: Student can able to understand queue data structure Broad Objectives of

the chapter/topic are:

1. Able to understand about linear queue Data Structure

2. Student can able to understand linear queue operation (insert at front, delete at rear)

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy):

1. **Discuss** the operation in queue? (Level 2)

2. **Explain** the overflow and underflow condition for Queue data structure? (Level 4) 3. What do you

understand by the real life example of queue? (Level 2)

HOME WORK: related to Topic objective and outcome as expressed in terms of indicators/criteria

1. What is the difficulties of linear queue and how overcome it?

QUIZ: related to Topic objective and outcome (new quiz with real world examples)

1. Which data structure allows deleting data elements from and inserting at rear?

A. Stack B. Queues
C. Tree D. Linked List

2. A .....is a data structure that organizes data similar to a line in the supermarket, where the first one in line is the first one out.

A. Queue l B. Stacks
C. Both of them D. Neither of them

LABORATORY EXPERIMENT: related to the Topic objective and outcome

1. Implement Linear Queue Operation in C programming language using array and linked list.

UNIT: 4&5

Title : Tutorial-IV Date:

07/08/15 Day: Friday

UNIT:4

TitleLinearDataStructure(CircularQUEUE) Date:

11/08/15 Day: Tuesday

CONTENTS

1) CIRCULAR Queue

2) Operation of CURCULAR Queue(insert at front ,delete at rear ,traverse)

3)Implementation using array

4)DEQUEUE-Definitions

5)Operation of DE QUEUE(Insert left, Delete left)

Unit Objectives: Student can able to understand Circular queue data structure Broad Objectives of the

chapter/topic are:

1. Able to understand about circular queue Data Structure
2. Student can able to understand circular queue operation (insert at front, delete at rear)
3. Student can able to know how it use full in real life.
4. Able to understand about Double ended queue Data Structure
5. Student can able to understand Double ended queue operation (insert at left, delete at left)

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy):

1. **Discuss** the operation in Circular queue? (Level 2)
2. **Describe** the overflow and underflow condition for Circular Queue data structure? (Level 2)
3. **Outline** the real life example of queue. (Level 4)
4. **Describe** the Over flow and Under flow condition of Deque. (Level 2)
5. **Explain** the algorithm for traversal of deque. (Level 4)

HOME WORK: related to Topic objective and outcome as expressed in terms of indicators/criteria

1. Take a circular queue **CQ** which is allocated 5 memory cells starting from **CQ[0] to CQ[4].** Perform the following operations one by one on it and write down **front** and **rear** value in each and every step.

(i) Insert 23,12,45,33 (ii) Delete two elements (iii) Insert 43, 56 (iv) Delete one element (v) Insert 10

QUIZ: related to Topic objective and outcome (new quiz with real world examples)

1. Let queue be a circular array having size 5. Now front=5 and rear=5 indicates that the queue----------

(a) is empty (b) is full (c) contains only one element (d) none of these

2. A linear list in which elements can be added or removed at either end but not in the middle, is known as

(a) Queue (b) Deque (c) Stack (d) Tree

3. Identify the data structure which allows deletions at both ends of the list but insertion at only one end.

A. Input restricted dequeue B. Output restricted qequeue

C. Priority queues D. Stack

LABORATORY EXPERIMENT: related to the Topic objective and outcome

1. Implement Circular Queue Operation in C programming language using array.
2. Implement DOUBLE ENDED Queue Operation in C programming language using array (insert left and delete left)

TOPIC/UNIT/CHAPTER: 3

Title Linear Data Structure(DE-QUEUE) Date:

12/08/15 Day: Wednesday

CONTENTS

1)DE–QUEUE OPERATION (Insert right, Delete right) 2)Traverse

3)Priority Queue

Topic/Unit/Chapter Objectives: Student can able to understand De Queue data structure Broad Objectives of

the chapter/topic are:

1. Able to understand about Operation of Double ended queue Data Structure
2. Student can able to understand Double ended queue operation(insert at right, delete at right)

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy):

1. **Produce** the algorithm for insert right? (Level 3)
2. **Outline** the over flow and under flow condition for insert right and delete right? (Level 4)
3. What do you **understand** by Priority Queue? (Level 2)

LABORATORY EXPERIMENT: related to the Topic objective and outcome

1. Implement DOUBLE ENDED Queue Operation in C programming language using Array (insert left and delete left)

UNIT: 3

Title :Tutorial-IV

Date: 14/08/15 Day: Friday

1. **Describe** the Over flow and Under flow condition of Deque.
2. **Propose**an algorithm for traversal of deque.

UNIT: 3

Title : Linear Data Structure(Circular Linked List) Date:

19/08/15 Day: Tuesday

CONTENTS

1) Circular Linkedlist. (Definition)
2) Operation of circular linked list.
3) Double Linkedlist.(Definition)
4) Operation of Double linked list (Create,Traverse)

Topic/Unit/Chapter Objectives: Student can able to understand Operation of De Queue data structure Broad Objectives of the chapter/topic are:

1. Student can able to **understand** Circular linked list.
2. How to create, traverse a circular linked list.
3. How to Insert and Delete an element from a circular linked list?
4. Student can able to **understand** double linked list.
5. **How** to Create and traverse the double linked list?
6. Write down the advantages of doubly linked list over singly linked list.

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy):

1. **Explain** an algorithm for Creation and traversal of Circular linked list. (Level 4)
2. **Explain** the algorithm for insertion and deletion of Circular linked list. (Level 4)
3. **Explain** an algorithm for Creation and traversal (forward and backword direction) of Double linked list. (Level 4)
4. **Compare** between singly linked list and doubly linked list. (Level 4)

HOME WORK: related to Topic objective and outcome as expressed in terms of indicators/criteria

1) Draw circular linked lists which have 5 nodes.
2) Draw a double linked list which has 5 nodes.

QUIZ: related to Topic objective and outcome (new quiz with real world examples)

1. The disadvantage in using a circular linked list is.....
   A. It is possible to get into infinite loop
   B. Last node points to first node.
   C. Time consuming
   D. Requires more memory space

LABORATORY EXPERIMENT: related to the Topic objective and outcome

1. Implement the following operation of circular linked list a)Create

   b)Traverse

   c)Insert first
   d)insert last

   e)Delete first
   f)delete last

TOPIC/UNIT/CHAPTER: 3

Title: Doubly linked list Date:

20/08/15 Day: Wednesday

CONTENTS

Operations of Doubly linked list(Insert, Delete)

Topic/Unit/Chapter Objectives: Student can able to **understand** about Circular linked list and its operation.

Broad Objectives of the chapter/topic are:

1. How to Insert and Delete an element from a double linked list.

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy):

1. **Explain** an algorithm for insertion of Double linked list. (Level 4)
2. **Explain** an algorithm for deletion of Double linked list. (Level 4)

LABORATORY EXPERIMENT: related to the Topic objective and outcome

1)Implement the following operation of double linked list a)Create
b)Traverse
c)Insert first d)insert last
e)Insert at specified position f)Delete first g)Delete at specified position
h)delete last

TOPIC/UNIT/CHAPTER: 3

Title:Tutorial-VI

Date: 22/08/15 Day: Friday

1. How to delete node at beginning, ending and at specific position?

UNIT: 3

Title: Linear Data Structure(Application of linked list) Date:

25/08/15 Day: Tuesday

CONTENTS

1. Representation of Polynomial expression using array
2. Representation of Polynomial expression using linked list
3. Polynomial addition using linked list
4. Polynomial multiplication using linked list

Topic/Unit/Chapter Objectives: Student can able to **understand** about double linked list and its operation.

Broad Objectives of the chapter/topic are:

1. Student can able to **understand** polynomial addition.
2. Student can able to **understand** polynomial multiplication.

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy): 1. **Explain** an algorithm for Polynomial addition. (Level 4) 2. **Explain** an algorithm for Polynomial multiplication. (Level 4)
LABORATORY EXPERIMENT: related to the Topic objective and outcome 1. Implement the following operation of linked list a. Polynomial addition. b. Polynomial multiplication

UNIT: 6 Title : NON -Linear Data Structure(Tree) Date: 26/08/15 Day: Wednesday
CONTENTS 1.Define Tree and its terminology 2.Definition of binary tree with examples 3. Types of Tree(complete , strictly , extended) 4. Expression Tree
Topic/Unit/ChapterObjectives:Studentcanableto**understand**aboutoperationofdoublelinkedlist Broad Objectives of the chapter/topic are: 1. Student can able to **understand** Tree. 2. Concepts of binary tree
Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy): 1. Whatdo you **understand** by complete binary tree? (Level 2) 2. **Describe**the following terms : Degree , terminal ,root node, height , child (Level 2)

HOMEWORK: related to Topic objective and outcome as expressed in terms of indicators/criteria NA

1) Prove that $n_o = n_2+1$ where no is the terminal and n2 is non terminal node degree 2.

QUIZ: related to Topic objective and outcome (new quiz with real world examples)

1. In array representation of binary tree, if the index number of a child node is 6 then the index number of its parent node is

(a) 2 (b) 3 (c) 4 (d) 5

UNIT: 3

Title : Tutorial-VII Date:

28/08/15 Day: Friday

1. Construct an Expression tree for this following expression: (A + (B-C)) * ((D-E)/ (F+G-H))

2. Consider the following Preorder and In order traversals of a binary tree.

Preorder : A B D G H E I C F J K

Inorder : G D H B E I A C J F K 5

UNIT: 6

Title : NON-Linear Data Structure(BST) Date:

01/09/15 Day: Tuesday

CONTENTS

1. Definitions of BST
2. Construct BST from in order, pre order and post order traversal.
3. BST operations using algorithms[Create, Traverse(Recursive and non-recursive)]

Topic/Unit/Chapter Objectives: Student can able to **understand** about application of link list Broad Objectives of the chapter/topic are:

1. Student can able to know the operation of binary search tree.

2. Student can able to know how to construct BST from pre order, post order and in order.
Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy): 1. **Explain** the Algorithm for finding number of node from a BST.(Level 4) 2. **Explain** an algorithm for finding inorder predecessor of root node from non-empty BST.(Level4) 3. **Describe** BST. (Level2) 4. **Write** an algorithm for create and traverse BST. (Level 1)
HOME WORK: related to Topic objective and outcome as expressed in terms of indicators/criteria 1. Write an algorithm inorder traversal of BST in non-recursive way.
LABORATORY EXPERIMENT: related to the Topic objective and outcome **1.** Implement the following BST Operation a) Create b)Traverse(preorder, in order, post order in recursive way) c)Traverse(preorder, in order in non-recursive way)

UNIT: 6 Title : NON-Linear Data Structure(BST) Date: 02/09/15 Day:Wednesday
CONTENTS BST operations using algorithms(Insertion)
Topic/Unit/Chapter Objectives: Student can able to **understand** about nonlinear data structure like Tree and its terminology. Broad Objectives of the chapter/topic are: 1.How to insert a node in recursive as well as non-recursive way in a BST?
Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy): 1**. Explain** the Algorithm to insert a node in a BST.(Level 4)

HOME WORK: related to Topic objective and outcome as expressed in terms of indicators/criteria 1.Insert following

elements in BST:44,12,34,78,90,6,22,87

1. Implement the following BST Operation
   a) Insert the node using recursive and non-recursive way

UNIT:

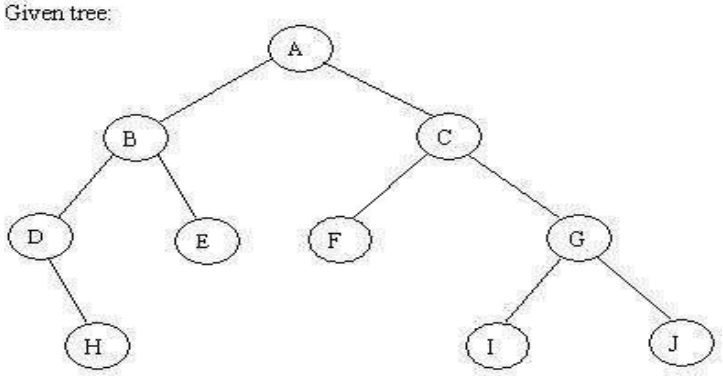
Title : Tutorial-VIII Date:

04/09/15 Day:Friday

1) Write an Algorithm for finding in order successor of root node.

2) Traverse the given tree using Inorder, Preorder and Postorder traversals.

Given tree:



UNIT: 6

Title: NON-Linear Data Structure(BST) Date:

08/09/15 Day:Tuesday

CONTENTS

BST operations using algorithms(Deletion)

Topic/Unit/Chapter Objectives: Explanation of operation of binary search tree. Broad Objectives of the chapter/topic are: 1**. Able to understand** the Algorithm for deleting node from a BST.
Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy): 1**. Explain** the Algorithm for deleting node from a BST.(Level 4)
HOME WORK: related to Topic objective and outcome as expressed in terms of indicators/criteria 1. Write an Algorithm for finding in order successor of root node.
LABORATORY EXPERIMENT: related to the Topic objective and outcome **1.** Implement the following BST Operation Delete the node

UNIT: 6 Title : NON -Linear Data Structure(Threaded Binary Tree) Date: 09/09/15 Day: Wednesday
CONTENTS **1.** Threaded Binary Tree **2.** Classification of Threaded Binary Tree. **3.** Traversal of Threaded Binary tree.
Topic/Unit/Chapter Objectives: Explanation of operation of threaded binary tree. Broad Objectives of the chapter/topic are:. 1. Student can able to **understand** about threaded binary tree. 2. Student can able to know the classification of Threaded Binary tree
Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy): 1. Whatdo you **understand** by Threaded Binary tree? (Level 2) 2. **Implement** an algorithm for In order Traverse of Threaded Binary Tree? (Level 3)

3. **Compare** the efficiency between threaded binary tree and BST? (Level 4)

HOME WORK: related to Topic objective and outcome as expressed in terms of indicators/criteria

1. Draw a Full Threaded Binary Tree which has seven nodes.

QUIZ: related to Topic objective and outcome (new quiz with real world examples)

1. If a binary tree is threaded for inorder traversal a right NULL link of any node is replaced by the address of its

(a) successor (b) predecessor (c) root (d) own

UNIT: 6

Title :Tutorial-IX

Date: 11/09/15 Day: Friday

1. Construct the Binary Search Tree by using the following traversals: Inorder:

DCKEAHBQJI

Postorder: DKECHQJIBA

2. Draw the expression tree for the following expressions-

i) A*B+C/D-E$F+G*H

ii) a$b+c–(d+e)/f*g +h

UNIT: 6

Title:NON-Linear Data Structure (AVL tree) Date:

15/09/15 Day:Tuesday

CONTENTS

1. AVL Tree-Definitions
2. Balance Factor
3. Operation of AVL Tree(Single rotations, Double rotations)

Topic/Unit/Chapter Objectives: Explanation of more efficient Data structure than binary search tree. Broad Objectives of the chapter/topic are:

1. Student can able to **understand** about AVL tree.
2. Student can able to know the Operation of AVL tree.

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy):

1. What do you **understand** by AVL tree? (Level 2)
2. **Complete** the full form of AVL? (Level 3)
3. **Compare** BST and AVL tree.(Level 4)
4. What do you **understand** by pivot node in AVL tree? (Level 2)
5. Whatdo you **understand** by Balance factor? (Level 2)

HOME WORK: related to Topic objective and outcome as expressed in terms of indicators/criteria

1. Draw all the general form of rotation for insert in an AVL tree.
2. Insert the following keys in AVL tree and show the rotations.

   8, 12, 9, 11, 7, 6,66,2,1,44

QUIZ: related to Topic objective and outcome (new quiz with real world examples)

12. A binary search tree whose left subtree and right subtree differ in hight by at most 1 unit is called ……

A.AVLtree B. Red-blacktree
C.Lemmatree D. None of the above

TOPIC/UNIT/CHAPTER: 6

Title : NON -Linear Data Structure(AVL Tree) Date:

16/09/15 Day: Wednesday

CONTENTS

Explain Ro R1 R-1 rotation for delete an element

Topic/Unit/Chapter Objectives: Explanation of more efficient Data structure than binary search tree. Broad Objectives of the chapter/topic are:

1. Student can able to **understand** about rotation for delete a node from AVL tree

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy): 1. **Evaluate** the time complexity of AVL Tree? (Level 5)
HOME WORK: related to Topic objective and outcome as expressed in terms of indicators/criteria 1.Draw all the general form of rotation for delete an element from an AVL tree

TOPIC/UNIT/CHAPTER: 6 Title: NON-Linear Data Structure(B Tree) Date: 30/09/15 Day: Tuesday
CONTENTS **1.** Explain B Tree. **2.** Operation of B tree with example
Topic/Unit/Chapter Objectives: Explanation of deletion of element form B tree. Broad Objectives of the chapter/topic are: 1. Student can able to **understand** about B Tree. 2. Student can able to **know** the Operation of B tree.
Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy): 1. **Describe** B Tree tree?(Level 2) 2. **Discuss** the element is to be insert into B- Tree? .(Level 2) 3. **Describe** an element is to be Deleted from B- Tree? (Level 2)
HOME WORK: related to Topic objective and outcome as expressed in terms of indicators/criteria 1. Insert The following element in to B Tree of order 4 : 4,7,1,4,22,9,11,55,33,88,77 2. Delete The following element in to B Tree of order 4 : 4,7,1,4,22,9,11,55,33,88,77

UNIT: 1

Title : **Algorithm efficiency and analysisand Sorting**

Date: 01/10/15 Day: Wednesday

CONTENTS

1) Define asymptoticnotation.

2) Demonstrate the classification of asymptotic notation.

Topic/Unit/Chapter Objectives: Explanation of more efficient Data structure Broad

Objectives of the chapter/topic are:

1. Student can able to relate about Big O, Theta and Omeganotation.

2. Student can able to find complexity of an algorithm.

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy):

1.**Explain** Big O , Theta, Omega notation.(Level 4)

HOME WORK: related to Topic objective and outcome as expressed in terms of indicators/criteria

1. Provethat$3n^2+7n=O(n^2)$
2. Provethat$3n^2+7n=\Omega(n^2)$
3. Provethat$3n^2+7n=\Theta(n^2)$
4. Short notes on asymptotic notations.

QUIZ: related to Topic objective and outcome (new quiz with real world examples)

1.Which of the following shows the correct relationship among some of the more common computing times foralgorithm?

(a) $O(\log n) < O(n) < O(n*\log n) < O(2^n) < O(n^2)$

(b) $O(n) < O(\log n) < O(n*\log n) < O(2^n) < O(n^2)$

(c) $O(n) < O(\log n) < O(n*\log n) < O(n^2) < O(2^n)$

(d) $O(\log n) < O(n) < O(n*\log n) < O(n^2) < O(2^n)$

UNIT: 9

Title : Searching

Date: 06/10/15 Day: Tuesday
CONTENTS 1) Searching- Linear Search, Binary search, Interpolation search 2) Time complexity of Linear Search, Binary search, Interpolation search
Topic/Unit/Chapter Objectives: Explanation of Sorting Broad Objectives of the chapter/topic are: 1. Student can able to understand about linear searching and its time complexity 2. Student can able to understand about binary searching and its time complexity 3. Student can able to understand about interpolation searching and its time complexity
Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy): 1. **Describe** searching? (Level2) 2. **Compare**Best,averageandworstcasetimecomplexityoflinearsearch.(Level4) 3.**Compare**Best, averageandworstcasetimecomplexityofbinarysearch.(Level4)
HOME WORK: related to Topic objective and outcome as expressed in terms of indicators/criteria 1)Search an smallest element from a matrix
QUIZ: related to Topic objective and outcome (new quiz with real world examples) 1.The worst case time complexity of binary search is (a)$O(n^2)$ (b)O(n) (c)O(logn) (d) O (n*log n)
LABORATORY EXPERIMENT: related to the Topic objective and outcome 1) Implement linear search, binary search and interpolation search in C programming language

UNIT: 9 Title :Sorting Date: 07/10/15 Day: Wednesday
CONTENTS 1. Bubble, Insertionsort 2. Time Complexity Analysis

Topic/Unit/Chapter Objectives: Student can able to understand about algorithm and how analyze time complexity of an algorithm.

Broad Objectives of the chapter/topic are:

1. **Explain** Bubble, Insertion sort algorithm. (Level 4)
2. **Explain** the time complexity analysis. (Level 4)

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy):

1. **Classify** the best, worst and average case time complexity of bubble sort. (Level 2)
2. **Classify** the best, worst and average case time complexity of insertion sort? (Level 2)
3. **Describe** modified bubble sort? (Level 2)

HOME WORK: related to Topic objective and outcome as expressed in terms of indicators/criteria 1.Draw the step of

Bubble sort for the following data element : 5,1,7,2,4,8

2.Draw the step of Insertion sort for the following data element : 5,1,7,2,4,8

QUIZ: related to Topic objective and outcome (new quiz with real world examples) 1.The best case time

complexity of the bubble sort technique is

(a) O (n) (b) $O(n^2)$ (c) O(nlogn) (d) O(logn)

2.The worst case time complexity of the insertion sort technique is

(a) O (n) (b) $O(n^2)$ (c) O(nlogn) (d) O(logn)

LABORATORY EXPERIMENT: related to the Topic objective and outcome

1. Implement program for following sorting algorithm a) Bubble sort.
   b) Insertion sort

UNIT: 1& 6

Title :Tutorial-X

Date: 09/10/15 Day: Friday

1. Find time complexity of the following algorithm: for(i=0;i<n;i++)

   for(j=i;j<n;j++)

for(k=j;k<n;k++)

s++;

2. Insert the following keys in the order given below to build them into an AVL tree:

9, 14, 32, 20, 5,25 ,46,68.

3. Insert the following keys into a B-tree of order 3:p,q,r,d,h,m,l,s,k,n

UNIT: 8

Title:Sorting

Date: 14/10/15 Day: Tuesday

CONTENTS

1. Selection Sort, Merge sort
2. Time Complexity Analysis

Topic/Unit/Chapter Objectives: Student can able to understand about searching algorithm. Broad Objectives of the chapter/topic are:

1. **Explain** selection and merge sort algorithm. (Level 4)
2. **Explain** the time complexity analysis. (Level 4)

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy):

1.Classify the best ,worst and average case time complexity of selection sort ?(Level 2) 2.**Classify** the best ,worst and average case time complexity of selection sort?(Level 2)

HOME WORK: related to Topic objective and outcome as expressed in terms of indicators/criteria 1.Draw the step of Selection sort for the following data element: 15,1,70,2,41,87

2.Draw the step of Insertion sort for the following data element : 5,11,7,12,47,8

QUIZ: related to Topic objective and outcome (new quiz with real world examples) 1.The best case time complexity of the merge sort technique is

(a) O (n) (b)$O(n^2)$ (c)O(nlogn) (d)O(logn)

LABORATORY EXPERIMENT: related to the Topic objective and outcome 2. Implementprogramforfollowingsortingalgorithm a)Selection sort a)Merge sort

UNIT: 8 Title :Sorting Date: 15/10/15 Day: Wednesday
CONTENTS 1.Quick sort algorithm and time complexity analysis
Topic/Unit/Chapter Objectives: student can able to understand about sorting and its time complexity Broad Objectives of the chapter/topic are: 1. Student can able to **understand** the algorithm of Quick sort 2. student can able to **understand** Time complexity of Quick sort
Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy): 1. **Compare** the best ,worst and average case time complexity of Quick Sort ?(Level 4) 2. **Find** the strategy which is used to implement Quick sort?(Level 4)
HOME WORK: related to Topic objective and outcome as expressed in terms of indicators/criteria 1. Draw the step of Quick sort for the following data element : 5,1,7,2,4,8,9,11,6
QUIZ: related to Topic objective and outcome (new quiz with real world examples) 1.The best case time complexity of the quick sort technique is (a) O (n) (b)O(n^2) (c)O(nlogn) (d)O(logn)
LABORATORY EXPERIMENT: related to the Topic objective and outcome 1.Implement program for following sorting algorithm a)Quick sort

UNIT: 8& 9 Title :Tutorial-XI

Date: 16/10/15 Day: Friday
1. Give a comparative study among bubble, insertion and selection sort with examples. 2. Write the linear search algorithm. What is the best time and worst time complexity of this algorithm. 3. Write the binary search algorithm. What is the best time and worst time complexity of this algorithm.

UNIT:8 Title: Sorting Date: 28/10/15 Day: Wednesday
CONTENTS **1.** Shell sort and Radix sort **2.** Time complexity analysis
Topic/Unit/Chapter Objectives: student can able to understand about more efficient sorting Algorithm and its time complexity. Broad Objectives of the chapter/topic are: 1. Student can able to **understand** Shell sort. 2. Student can able to **understand** Radix sort.
Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy): **1. Implement** the algorithm of Shell Sort. **2. Implement** the algorithm of Radix Sort?
HOMEWORK: related to Topic objective and outcome as expressed in terms of indicators/criteria 1.Draw the step of Shell sort for the following data element : 511,100,79,24,402,801,319,101,604.666,222,873,471,902,184 2.Draw the step of Radix sort for the following data element : 511,100,79,24,402,801,319,101,604.666,222,873,471,902,184
LABORATORY EXPERIMENT: related to the Topic objective and outcome 1.Implement program for following sorting algorithm a)Shell sort b)Radix sort

UNIT:8

Title: Tutorial -XII Date:

30/10/15 Day: Friday

1. Sort the given values using Quick Sort.

65	70	75	80	85	60	55	50	45

.

2. Sort the given values using Merge Sort.

65	70	75	80	85	60	55	50	45

UNIT: 8

Title Sorting

Date: 03/11/15 Day: Tuesday

CONTENTS

1) Algorithm for Heap sort

2) Construction of Heap tree

3)Time complexity analysis

Topic/Unit/Chapter Objectives: student can know the algorithm and complexity analysis of merge sort. Broad Objectives of the chapter/topic are:

3. Student can able to **understand** the algorithm of heap sort

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy):

1.**Compare**the best ,worst and average case time complexity of Heap Sort ?(Level 4)

2. **Explain** the Heap sort algorithm? (Level 4)
HOME WORK: related to Topic objective and outcome as expressed in terms of indicators/criteria 1.Draw the step of Heap sort for the following data element: 5,1,7,2,4,8,9,11,6
LABORATORY EXPERIMENT: related to the Topic objective and outcome 1.Implement program for following sorting algorithm a)Heap sort

UNIT: 5 Title: NON-Linear Data Structure(Graph) Date: 04/11/15 Day: Wednesday
CONTENTS 1) Graph definition 2) Types of Graph: Directed, undirected, complete graph 3) Definitions- weighted/un-weighted edges, sub-graph, degree, cut-vertex/articulation point, pendant node, clique, complete graph, connected components – strongly connected component, weakly connected component, path, shortest path, isomorphism
Topic/Unit/Chapter Objectives: student can know the algorithm and complexity analysis of Heap sort. Broad Objectives of the chapter/topic are: 1.Abletounderstanddefinitionofgraph. 2.Able to learn deferent terminology of graph 3. Able to understand different types of graph?
Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy): 1. **Describe** the definition of graph? (Level 2) 2. **Identify** directed or undirected graph?(Level 4)

3. **Describe** the definition of different types of graphs? (Level 2) 4. **Identify** isomorphism of graph? (Level 4)
HOME WORK: related to Topic objective and outcome as expressed in terms of indicators/criteria 1. Drawan un directed graph which have 8 vertex and represent it using array.
QUIZ: related to Topic objective and outcome (new quiz with real world examples) 1.The vertex, removal of which makes a graph disconnected, is called (a)pendant vertex (b)bridge (c)articulation point (d)none of these

UNIT: 8 & 5 Title : Tutorial XII Date: 06/11/15 Day: Friday
1. Create a heap (max/min) with the following data 33,25,67,89,12,55,3,67. And sort the data in ascending and descending order. 2. Short notes on heap sort. 3. Draw a directed graph which have 8 vertex and represent it using array.

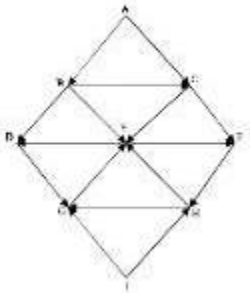
UNIT: 4 Title : NON-Linear Data Structure(Graph) Date: 17/11/15 Day: Tuesday
CONTENTS 1) Graph representations/storage implementations – adjacency matrix, adjacency list, adjacency multi- list. 2) Graph Traversal-BFS and DFS (algorithms with examples)
Topic/Unit/Chapter Objectives: student can know the algorithm and complexity analysis of Radix sort. Broad Objectives of the chapter/topic are: 1. Able to understand adjacency matrix and list. 2. Able to understand BFS and DFS traversal of graphs 3. Comparison study about BFS and DFS

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy):

1. How to **construct** adjacency matrix of a graph? (Level 6)
2. How to **construct** a graph using linked list? (Level 6)
3. **Explain** DFS with example. (Level 4)
4. **Describe** the data structure need to develop DFS? (Level 2)
5. **Explain** BFS with example. (Level 4)
6. **Describe** the data structure need to develop BFS? (Level 2)

HOME WORK: related to Topic objective and outcome as expressed in terms of indicators/criteria

1. Traverse the following Graph using DFS and BFS



TOPIC/UNIT/CHAPTER: 5

Title: NON-Linear Data Structure(Graph) Date:

18/11/15 Day: Wednesday

CONTENTS

1) Spanning Tree
2) Minimum Spanning Tree
3) Prim's algorithm.

Topic/Unit/Chapter Objectives: how to define graph and how to represent graph Broad Objectives

of the chapter/topic are:

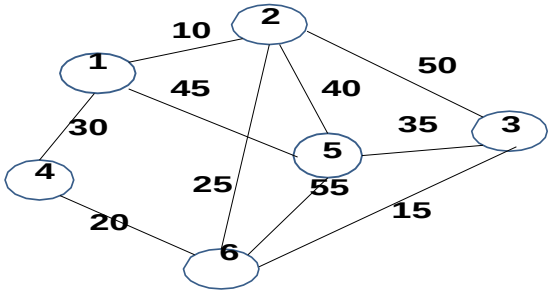
1. Able to know about spanning tree.
2. Able to understand minimum spanning tree.
3. Able to know about Prim's algorithm with example.

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy):

1. **Describe** minimum spanning tree? (Level 2)
2. **Explain** prim's algorithm with example. (Level 4)

HOME WORK: related to Topic objective and outcome as expressed in terms of indicators/criteria

1. Using Prim's Algorithm to find the minimum spanning tree (MST) of the given graph.

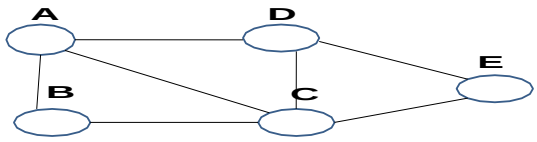


TOPIC/UNIT/CHAPTER: 5

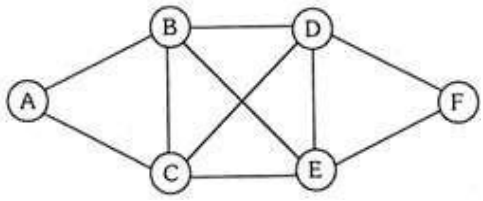
Title :Tutorial-XIV Date:

20/11/15 Day: Friday

1. Starting from the vertex A show BFS and DFS traversal of the following graph.

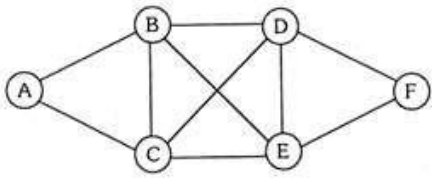


2. Find out the BFS tree for the given graph.

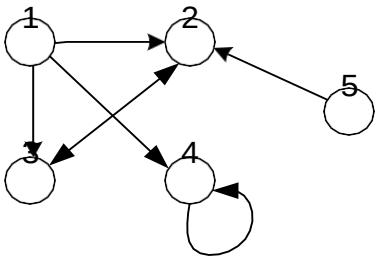
1. 

3. Find out the DFS tree for the given graph.

1.



4. Find out the DFS tree and classified the edges for the following Graph where start vertex is '1'.



UNIT: 10

Title :**Hashing**

Date: 24/11/15 Day:Tuesday

CONTENTS

1)Definition of Hashing

2)Different types of Hashing

3)Collision Resolution techniques

Topic/Unit/Chapter Objectives: student can able to relate how sparse matrix can utilize for space optimization in memory

Broad Objectives of the chapter/topic are:

1. Student can able to understand hashing.
2. Student can able to understand how many types of hashing techniques are there?
3. Student can able to understand about collision resolution techniques.

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy):

1. **Describe**Hashing .(Level2) 2. **Describe** theutilizationofdifferenttypesofhashing?(Level2) 3.**Describe**different types of collision resolution techniques. (Level 2)
HOMEWORK:relatedtoTopicobjectiveandoutcomeasexpressedinterms ofindicators/criteria 1. Calculate load factor.

TOPIC/UNIT/ CHAPTER: Title **:WBUT QUESTION ANSWER SESSION** Date: 25/11/15 Day:33
CONTENTS Last 5 years university question paper.
Topic/Unit/Chapter Objectives: student can able to relate how sparse matrix can utilize for space optimization in memory Broad Objectives of the chapter/topic are: 1. They are able to explain to analyze, investigate and evaluate. 2. They are able to judge how to apply theory.
Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities (Performance Criteria/Indicators with Levels of Bloom's Taxonomy): **Discussion most of the university questions in last 5 years.**

a) Teaching Strategy/Method (describe instructional methods, usage of ICT, efficient and engaging instructions and display the best practices on institutional website)

1) To giveAssignments
2) By giving more interesting examples
3) Giving lectures in power point presentation

b) Strategy to support weak students

1) To engage the weak students in habit of studying, I give him some easy questions in regular basis.
2) Some weak students also have a problem that they forget what they learn. In my class I always give some tips on how to recall and how to write systematically.
3) Weak students need special attention even after college hours. I always gives some extra hours to a weak student.

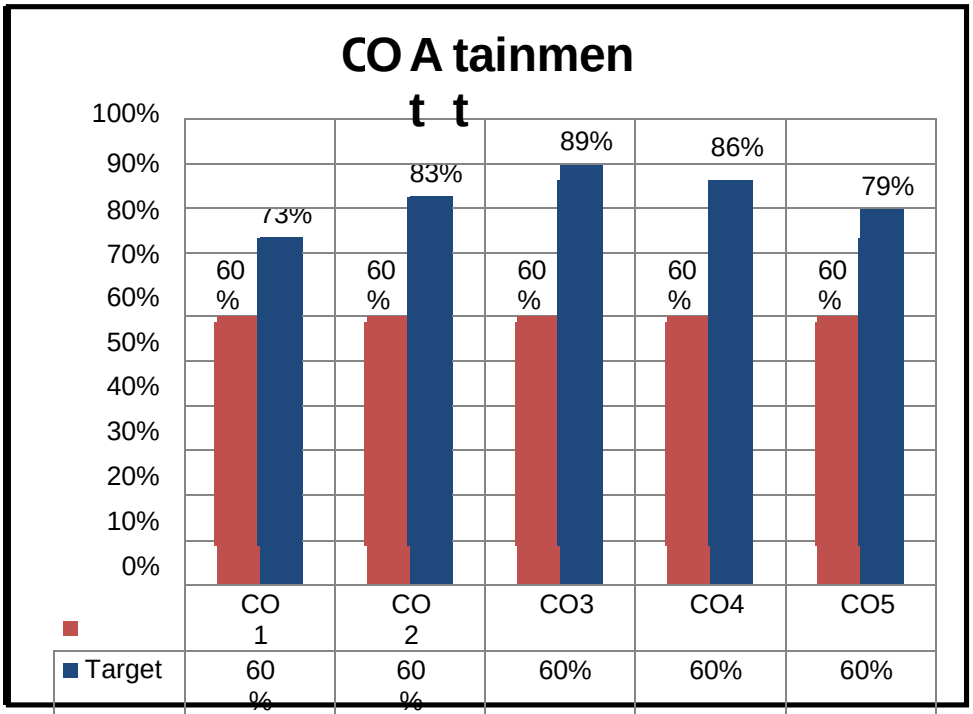
c) Strategy to encourage bright students

1) Have an extra challenge ready that allows the student to go deeper into the subject, learn a little more, or apply a skill he has just learned in a new way.
2) Some students are engaged with the final year students for their final project.

d) Efforts to keep students engaged

1) Regular basis Home Work.
2) 5-10 minutes spend in an every class for question answer session.
3) Quiz in regular basis.
4) Some technical assignments in group wise.

e) Analysis of Students performance in the course (internal) (labs, seminars, tests, assignments, quiz, exam etc)



	CO1	CO2	CO3	CO4	CO5
Target	60%	60%	60%	60%	60%
Attained	73%	83%	89%	86%	79%

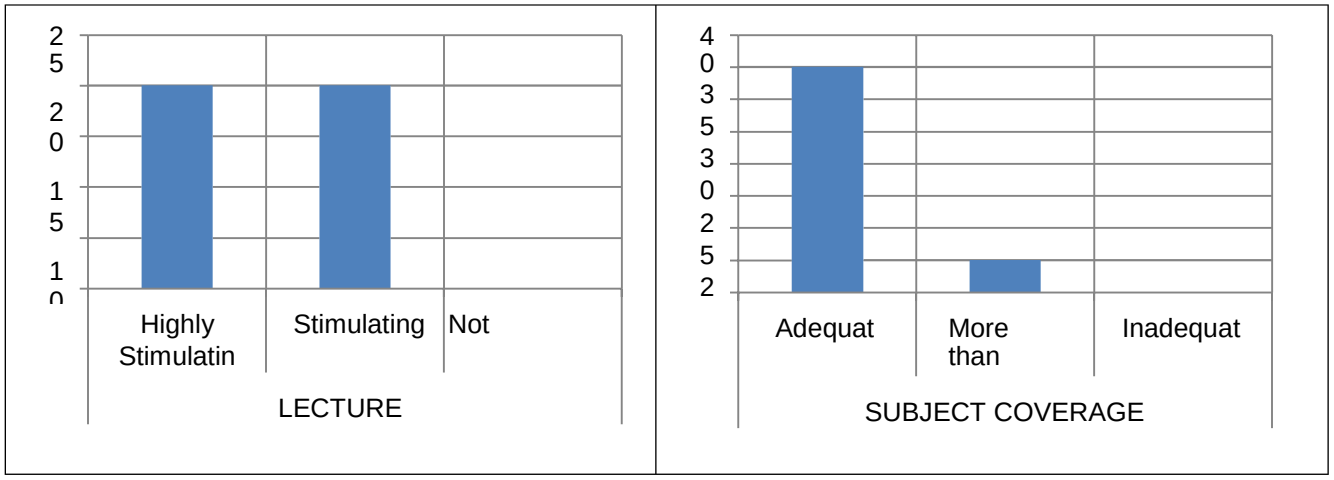
Comments:

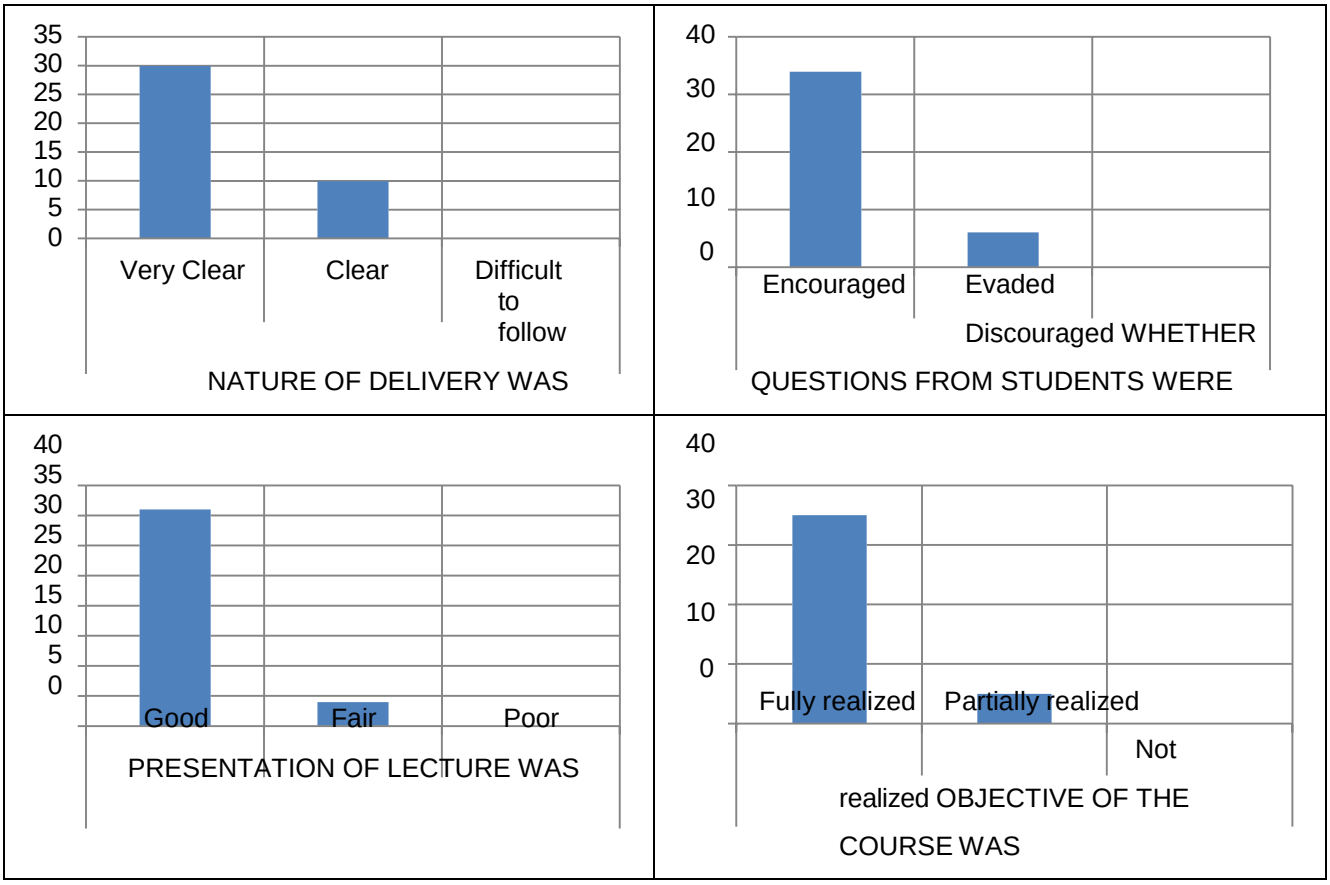
- 73%studentshaveattainedthesettargetof60%marksforCO1
- 83%studentshaveattainedthesettargetof60%marksforCO2
- 89%studentshaveattainedthesettargetof60%marksforCO3
- 86%studentshaveattainedthesettargetof60%marksforCO4
- 79%studentshaveattainedthesettargetof60%marksforCO5

f) Analysis of Students performance in the course (university results)

	Target Course Outcome%	TOTAL STUDENTS	TOTAL STUDENT WHO ATTAINED OUTCOME	% STUDENTS WHO ATTAINED THE OUTCOME
University Result	**60%**	**40**	**36**	**90%**

g) Student Feedback





h) Teacher Self-Assessment (at the completion of course)

At the completion of course I have understood that CO1 and CO5 has reached the attainment levels bot not satisfactorily.. That's why more assignments and quiz questions should be provided.

i) Recommendations/Suggestions for improvement by faculty

Text books are available in the library but in previous edition.That's why books should be updated.

Siliguri Institute of Technology
INTERNAL ASSESSMENT
REPORT
Paper Name: Data Structure & Algorithm
Paper Code: CS 302

FACULTY NAME: **Ms.SUTAPA BHATTACHARYA** **YEAR: 2015**

STREAM: **B.TECH[CSE]** YEAR: **2ND** SEMESTER: **IST** SECTION: **B** NO. OF CLASS HELD: **52& 29(For Lateral)**

Hewlett-PackardCOURSE FILE ON DATA STRUCTURE AND

SN	NAME	ROLL NO.	ATTENDANCE [5 MARKS]		MARKS IN INTERNAL EXAM[15 MARKS]			QUIZ [10 MARKS] MARKS=[((I+II)/30)*100]/10			TOTAL [30 MARKS]
			TOTAL %	MARKS	I	II	AVG	Q-I [15]	Q-II [15]	MARKS	
1	RAKESH KUMAR	11900114049	80.77	5	25	28	14	8	11	7	26
2	RISAB BISWAS	11900114050	75	4	25	28	14	12	15	9	27
3	RISHITA CHOWDHURY	11900114051	88.46	5	25	27	14	9	10	7	26
4	RIYA MITRA	11900114052	80.77	5	29	27	15	9	12	7	27
5	RUPAM MITRA	11900114053	46.15	3	16	AB	8	13	9	8	19
6	SACHIN KUMAR SAHA	11900114054	61.54	4	23	22	12	11	13	8	24
7	SAGAR BHATTARAI	11900114055	92.31	5	23	18	11	9	9	6	22
8	SAGARIKA MITRA	11900114056	92.31	5	22	29	14	10	11	7	26
9	SAHITYA KAUSHIK	11900114057	92.31	5	24	29	14	9	11	7	26
10	SAMIK ANWAR	11900114058	88.46	5	29	28	15	13	13	9	29
11	SAMRAT BHATTACHARJEE	11900114059	38.46	3	AB	03	2	8	9	6	11
12	SANDIPAN CHAKRABORTY	11900114060	67.31	4	AB	22	6	13	13	9	19
13	SANGAM GURUNG	11900114061	86.54	5	27	26	14	12	12	8	27
14	SANTANU RAKSHIT	11900114062	67.31	4	23	24	12	8	9	6	22
15	SAPTARSHI GHOSH	11900114063	100	5	10	03	4	10	11	8	17
16	SAYAN CHAKRABORTY	11900114064	48.08	3	08	04	4	7	7	5	12
17	SHALINI PRADHAN	11900114065	94.23	5	24	27	13	15	15	10	28
18	SHALINI ROY CHOWDHURY	11900114066	57.69	3	25	26	14	12	12	8	25
19	SHASHI KANT PATEL	11900114067	90.38	5	24	24	12	12	12	8	25
20	SHIRSANA GHATAK	11900114068	48.08	3	15	14	8	11	11	8	22
21	SNEHA PARIJAAT	11900114069	76.92	4	22	15	10	12	13	9	23

22	SOHAM SARKAR	11900114070	86.54	5	29	18	13	10	11	7	25
23	SOURAVENDU NANDY	11900114071	71.15	4	27	23	13	12	12	8	25
24	SOUVIK BISWAS	11900114072	80.77	5	29	28	15	10	10	7	27
25	SRIJA GHOSH	11900114073	76.92	4	20	22	11	12	12	8	23
26	SUBHAM GUHA	11900114074	36.54	3	AB	09	3	10	10	7	13
27	SUBHOJIT KUNDU	11900114075	71.15	4	AB	25	7	12	12	8	19
28	SUDIPTA SAHA	11900114076	67.31	3	29	17	13	7	10	6	22
29	SURAJ SHARMA	11900114077	73.08	4	20	17	10	12	14	9	23
30	SURAJIT KUMAR DAS	11900114078	76.92	4	28	24	13	12	14	9	26
31	SWARNAVA MUKHERJEE	11900114079	92.31	5	28	29	15	12	12	8	28
32	SWEETY	11900114080	71.15	4	19	24	11	9	11	7	22
33	UJJAL DAS	11900114081	76.92	4	23	18	11	8	8	6	21
34	VINITA KUMARI	11900114082	86.54	5	14	10	7	12	12	8	20
35	ANIRBAN HALDAR	11900114086	57.69	3	17	20	10	10	8	6	19
36	ADRIJA PAUL(L)	11900115095	62.06	4	13	13	8	9	12	7	20
37	BINDHYA MANGAN(L)	11900115096	62.06	4	18	17	10	10	10	7	21
38	POOJA UPADHYAY(L)	11900115097	65.50	4	20	17	10	13	12	9	23
39	RAJAT MUKHIA(L)	11900115098	82.75	5	22	24	12	14	14	10	27
40	SHRADHANJALI PRADHAN(L)	11900115099	86.20	5	22	11	14	11	8	7	26

Siliguri Institute of Technology
ATTENDANCE SHEET (LECTURE)
Paper Name: Data Structure and Algorithm
Paper Code: CS302

ROLL NO.	21/7(2)	22/7	23/7	28/7(2)	30/7	4/8(2)	5/8	6/8	11/8(2)	12/8	19/8(2)	25/8(2)	26/8	1/9(2)	8/9(2)	9/9	12/9(2)	15/9(2)	16/9	30/9	1/10(2)	5/10	6/10(2)	2/11(2)	3/11(2)	4/11(3)	6/11(2)					
11900114049	0	0	0	2	1	2	1	0	2	1	2	0	0	2	2	1	2	2	1	1	2	1	2	2	2	3	0					
11900114050	2	0	1	2	1	2	1	1	2	1	0	2	1	0	2	0	0	2	1	0	2	1	2	2	2	3	0					
11900114051	2	1	1	2	1	2	1	0	2	1	2	2	1	2	2	0	2	2	1	0	2	1	2	2	2	3	0					

11900115098	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	1	0	1	1	1	1					
11900115099	0	0	1	1	0	0	0	1	1	1	1	0	1	1	0	1	1	1	0	1	1	1	0	0	0	0	1					

Siliguri Institute of Technology
ATTENDANCE SHEET (TUTORIAL CLASS)
Paper Name: Data Structure& Algorithm
Paper Code: CS 302

FACULTY NAME: **Ms. SUTAPA BHATTACHARYA** **YEAR: 2015**

STREAM: **B.TECH[CSE]** YEAR: **3RD** SEMESTER: **IST** SECTION: **B** NO. OF CLASS HELD: 12

SN	NAME	ROLL NO.	24/7	31/7	7/8	14/8	21/8	28/8	4/9	11/9	21/9	9/10	2/11	Total
1	RAKESH KUMAR	11900114049	1	1	1	0	1	0	1	1	1	0	0	7
2	RISAB BISWAS	11900114050	1	1	0	1	1	0	0	1	1	0	0	6
3	RISHITA CHOWDHURY	11900114051	1	0	0	1	0	0	0	1	1	0	0	4
4	RIYA MITRA	11900114052	1	1	0	1	0	0	1	1	0	0	1	6
5	RUPAM MITRA	11900114053	1	0	1	0	1	0	1	0	1	1	1	7
6	SACHIN KUMAR SAHA	11900114054	0	0	0	0	0	1	0	0	0	0	0	1
7	SAGAR BHATTARAI	11900114055	1	1	1	0	1	0	1	0	1	0	0	6
8	SAGARIKA MITRA	11900114056	0	0	1	0	0	0	0	0	1	0	1	3
9	SAHITYA KAUSHIK	11900114057	0	0	0	0	0	1	1	1	1	1	1	6
10	SAMIK ANWAR	11900114058	1	0	1	0	0	1	0	1	1	0	1	6
11	SAMRAT BHATTACHARJEE	11900114059	0	1	1	0	1	0	1	1	1	1	1	8
12	SANDIPAN CHAKRABORTY	11900114060	0	1	1	1	0	1	0	0	1	1	0	6
13	SANGAM GURUNG	11900114061	0	1	0	0	1	0	1	1	0	0	1	5
14	SANTANU RAKSHIT	11900114062	0	1	1	0	1	1	0	0	0	1	1	6
15	SAPTARSHI GHOSH	11900114063	0	1	0	0	1	0	1	1	0	0	0	4
16	SAYAN CHAKRABORTY	11900114064	1	0	0	1	1	0	0	0	0	0	1	4
17	SHALINI PRADHAN	11900114065	1	1	0	1	1	0	0	1	0	1	0	6

18	SHALINI ROY CHOWDHURY	11900114066	0	0	1	0	1	0	0	1	1	0	0	4
19	SHASHI KANT PATEL	11900114067	1	1	0	0	0	1	0	0	1	1	0	5
20	SHIRSANA GHATAK	11900114068	1	0	0	1	1	0	0	0	1	0	1	5
21	SNEHA PARIJAAT	11900114069	1	0	1	0	0	0	0	0	0	0	0	2
22	SOHAM SARKAR	11900114070	1	1	0	0	1	1	1	1	1	0	0	7
23	SOURAVENDU NANDY	11900114071	1	0	1	1	0	0	0	1	1	1	0	6
24	SOUVIK BISWAS	11900114072	0	1	1	0	0	0	1	0	0	0	1	4
25	SRIJA GHOSH	11900114073	1	1	1	1	1	1	1	0	0	1	0	8
26	SUBHAM GUHA	11900114074	1	0	1	1	1	1	1	1	0	0	0	7
27	SUBHOJIT KUNDU	11900114075	0	1	1	0	0	1	1	0	1	0	0	5
28	SUDIPTA SAHA	11900114076	1	0	1	1	1	0	0	0	0	1	0	5
29	SURAJ SHARMA	11900114077	0	1	0	0	0	0	0	1	1	0	0	3
30	SURAJIT KUMAR DAS	11900114078	1	0	1	0	1	0	1	0	1	0	0	5
31	SWARNAVA MUKHERJEE	11900114079	1	0	1	1	1	1	0	0	0	0	1	6
32	SWEETY	11900114080	0	0	1	1	1	0	1	1	1	0	0	6
33	UJJAL DAS	11900114081	0	0	1	1	1	1	0	0	1	1	0	6
34	VINITA KUMARI	11900114082	1	1	1	0	1	0	1	1	0	1	1	8
35	ANIRBAN HALDAR	11900114086	0	0	0	0	1	1	0	0	1	0	0	3
36	ADRIJA PAUL(L)	11900115095	0	0	0	0	1	0	1	1	1	1	1	6
37	BINDHYA MANGAN(L)	11900115096	0	0	1	1	1	0	0	0	1	0	1	5
38	POOJA UPADHYAY(L)	11900115097	0	0	1	0	0	0	1	1	0	0	0	3
39	RAJAT MUKHIA(L)	11900115098	0	0	1	1	1	0	0	0	1	0	1	5
40	SHRADHANJALI PRADHAN(L)	11900115099	0	0	1	0	0	0	1	1	0	0	0	3

Siliguri Institute of Technology
LABORATORY ATTENDANCE
SHEET
Paper Name:
Paper Code: CS 392

FACULTY NAME:**Ms. SUTAPA BHATTACHARYA**

YEAR:2015

STREAM:**B.TECH[CSE]** YEAR:**3RD** SEMESTER:**IST** GROUP:**B1** No. of Practical:1 2

SN	NAME	DAY	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL MARKS
		DATE	**23/7**	**30/7**	**6/8**	**13/8**	**20/8**	**27/8**	**3/9**	**10/9**	**17/9**	**1/10**	**8/10**	**5/11**	
		ROLL NO													
1	RAKESH KUMAR	11900114049	0	1	1	1	1	1	1	1	1	1	1	1	**11**
2	RISAB BISWAS	11900114050	1	1	1	1	1	1	0	1	1	1	1	1	**11**
3	RISHITA CHOWDHURY	11900114051	1	1	0	1	1	1	1	1	1	1	1	1	**11**
4	RIYA MITRA	11900114052	1	1	0	1	0	0	1	1	0	0	1	1	**7**
5	RUPAM MITRA	11900114053	0	1	1	1	0	1	0	0	1	1	1	0	**7**
6	SACHIN KUMAR SAHA	11900114054	0	1	1	1	1	1	1	0	0	0	1	0	**7**
7	SAGAR BHATTARAI	11900114055	0	1	1	0	1	1	1	1	0	1	1	1	**9**
8	SAGARIKA MITRA	11900114056	1	1	0	1	1	1	1	1	1	0	1	1	**10**
9	SAHITYA KAUSHIK	11900114057	1	1	0	1	1	1	1	1	1	0	1	1	**10**
10	SAMIK ANWAR	11900114058	0	1	1	1	0	1	0	1	1	0	1	1	**9**
11	SAMRAT BHATTACHARJEE	11900114059	0	0	0	1	1	0	0	0	0	0	0	0	**2**
12	SANDIPAN CHAKRABORTY	11900114060	1	1	0	1	1	1	0	1	1	0	0	1	**8**
13	SANGAM	11900114061	1	1	1	1	1	1	1	1	0	1	1	1	**11**

	GURUNG														
14	SANTANU RAKSHIT	11900114062	0	1	1	1	1	1	0	0	1	1	0	1	**8**
15	SAPTARSHI GHOSH	11900114063	1	1	1	1	1	1	1	1	1	1	1	1	**12**
16	SAYAN CHAKRABORTY	11900114064	0	0	0	0	0	1	1	1	0	1	1	1	**6**
17	SHALINI PRADHAN	11900114065	1	1	1	1	1	1	1	1	1	1	1	1	**12**
18	SHALINI ROY CHOWDHURY	11900114066	0	1	1	1	0	1	1	1	0	1	1	1	**9**
19	SHASHI KANT PATEL	11900114067	1	1	1	1	1	1	1	0	0	1	1	1	**10**
20	SHIRSANA GHATAK	11900114068	0	1	1	1	1	1	1	1	0	0	1	0	**8**

Siliguri Institute of Technology
LABORATORY ATTENDANCE SHEET
Paper Name: Paper Code: CS 392

FACULTY NAME: **Ms. SUTAPA BHATTACHARYA**

YEAR: 2015

STREAM: **B.TECH[CSE]** YEAR: **3RD** SEMESTER: **IST** GROUP: **B2**

NO. OF PRACTICAL HELD: 11&7(Lateral)

SN	NAME	DAY	1	2	3	4	5	6	7	8	9	10	11	TOTAL MARKS
		DATE	**21/7**	**28/7**	**04/8**	**11/8**	**25/8**	**1/9**	**8/9**	**15/9**	**29/9**	**6/10**	**3/11**	
		ROLL NO.												
1	SNEHA PARIJAAT	11900114069	0	1	1	1	0	1	0	1	1	1	0	**7**
2	SOHAM SARKAR	11900114070	1	1	1	1	1	1	1	1	1	1	0	**10**
3	SOURAVENDU NANDY	11900114071	1	0	1	1	1	1	1	1	1	1	0	**9**
4	SOUVIK BISWAS	11900114072	1	1	1	1	1	1	1	0	1	1	0	**10**
5	SRIJA GHOSH	11900114073	1	1	1	1	1	1	1	1	1	1	1	**11**
6	SUBHAM GUHA	11900114074	0	1	0	0	0	1	1	1	0	0	0	**5**
7	SUBHOJIT KUNDU	11900114075	1	1	1	1	1	1	1	1	0	0	1	**9**

Hewlett-PackardCOURSE FILE ON DATA STRUCTURE AND

8	SUDIPTA SAHA	11900114076	1	1	1	1	1	1	1	1	1	1	0	**10**
9	SURAJ SHARMA	11900114077	1	1	1	1	1	1	1	1	0	1	0	**9**
10	SURAJIT KUMAR DAS	11900114078	0	1	1	1	1	1	1	1	1	1	1	**10**
11	SWARNAVA MUKHERJEE	11900114079	1	1	1	1	1	1	1	1	1	1	1	**11**
12	SWEETY	11900114080	0	1	1	1	0	1	0	1	1	1	0	**8**
13	UJJAL DAS	11900114081	1	1	1	1	0	1	0	1	1	1	0	**8**
14	VINITA KUMARI	11900114082	1	1	1	0	0	1	1	0	1	1	1	**8**
15	ANIRBAN HALDAR	11900114086	0	1	1	0	0	1	1	1	1	0	1	**7**
16	ADRIJA PAUL(L)	11900115095					0	0	1	1	1	0	1	**4**
17	BINDHYA MANGAN(L)	11900115096					0	1	1	1	1	0	1	**5**
18	POOJA UPADHYAY(L)	11900115097					1	1	1	1	1	0	1	**6**
19	RAJAT MUKHIA(L)	11900115098					0	1	1	1	1	1	1	**6**
20	SHRADHANJALI PRADHAN(L)	11900115099					0	0	1	1	1	1	1	**5**

Siliguri Institute of Technology

RECORDS OF ASSIGNMENTS/~~QUIZ~~

Paper Name: Data Structure& Algorithm

Paper Code: CS 302

SN	NAME	ROLL NO.	Assign - I	Assign - II	SN	NAME	ROLL NO.	Assign - I	Assign - II
1	RAKESH KUMAR	11900114049	1	1	21	SNEHA PARIJAAT	11900114069	1	1
2	RISAB BISWAS	11900114050	1	1	22	SOHAM SARKAR	11900114070	1	1
3	RISHITA CHOWDHURY	11900114051	1	1	23	SOURAVENDU NANDY	11900114071	1	1
4	RIYA MITRA	11900114052	1	1	24	SOUVIK BISWAS	11900114072	1	1
5	RUPAM MITRA	11900114053	1	1	25	SRIJA GHOSH	11900114073	1	1
6	SACHIN KUMAR SAHA	11900114054	1	1	26	SUBHAM GUHA	11900114074	1	1

7	SAGAR BHATTARAI	11900114055	1	1	27	SUBHOJIT KUNDU	11900114075	1	1
8	SAGARIKA MITRA	11900114056	1	1	28	SUDIPTA SAHA	11900114076	1	1
9	SAHITYA KAUSHIK	11900114057	1	1	29	SURAJ SHARMA	11900114077	1	1
10	SAMIK ANWAR	11900114058	1	1	30	SURAJIT KUMAR DAS	11900114078	1	1
11	SAMRAT BHATTACHARJEE	11900114059	1	1	31	SWARNAVA MUKHERJEE	11900114079	1	1
12	SANDIPAN CHAKRABORTY	11900114060	1	1	32	SWEETY	11900114080	1	1
13	SANGAM GURUNG	11900114061	1	1	33	UJJAL DAS	11900114081	1	1
14	SANTANU RAKSHIT	11900114062	1	1	34	VINITA KUMARI	11900114082	1	1
15	SAPTARSHI GHOSH	11900114063	1	1	35	ANIRBAN HALDAR	11900114086	1	1
16	SAYAN CHAKRABORTY	11900114064	1	1	36	ADRIJA PAUL(L)	11900115095	1	1
17	SHALINI PRADHAN	11900114065	1	1	37	BINDHYA MANGAN(L)	11900115096	1	1
18	SHALINI ROY CHOWDHURY	11900114066	1	1	38	POOJA UPADHYAY(L)	11900115097	1	1
19	SHASHI KANT PATEL	11900114067	1	1	39	RAJAT MUKHIA(L)	11900115098	1	1
20	SHIRSANA GHATAK	11900114068	1	1	40	SHRADHANJALI PRADHAN(L)	11900115099	1	1

Siliguri Institute of Technology
LIST OF PRACTICAL'S
Paper Name: Data Structure& Algorithm
Paper Code: CS 392

SN	Details of Experiment(s)	Hours Allotted
1	Implement the following Operation of Array data structure : 1) Insert and delete an element in to an Array. 2) Traverse thearray.	3 HRS
2	Implement the following Operation of Single linked list : 1) Create and Traverse a single linked list. 2) Insert and delete an element from a list	3 HRS

	3) Reverse a single list. 4) Searching the element from the list 5) Sorting the node values in ascending order	
3	1) Implement The following Stack Operation using Array and Linked List : a)PUSH() b)POP() c) Traversal 2) Write a program to implement Tower of Hanoi and 8 queen puzzle problem using recursion	3 HRS
4	1)Implement The following linear Queue Operation using Array and Linked list : a)Enqueue() b)Dequeue() c) Traversal 2)Implement The following Circular Queue Operation using Array : a)Enqueue() b)Dequeue() c) Traversal	3 HRS
5	Implement The following Doubleended Queue Operation using Array: a)Insert left() b)Insert right() c) Delete left() d) Delete right() e)Traversal()	3 HRS
6	Implement the following Operation of Double linked list : 1) Create and Traverse a double linked list. 2) Insert and delete an element from a list.	3 HRS
7	Implement the following Operation of Circular linked list : 1) Create and Traverse a double linked list. 2) Insert and delete an element from a list.	3 HRS
8	Write a program to implement polynomial addition and multiplication using linked list.	3 HRS
9	Implement The following Binary search Tree operation : a) Insert an element b) Delete an element c) Search an element	3 HRS
10	Develop the following sorting algorithm: a)Bubble sort b)Selection sort c) Insertion Sort d)Merge sort	3 HRS

11	Develop the following sorting algorithm: a)Quick sort b)Heap sort c)Shell sort	3 HRS
12	Develop the following searching algorithm: Linear Search, Binary Search and Interpolation search	3 HRS

Siliguri Institute of Technology
SESSIONAL/PRACTICAL PERFORMANCE RECORD
Paper Name: Data Structure and Algorithm Lab
Paper Code: CS 392

FACULTY NAME: **Ms SUTAPA BHATTACHARYA**
YEAR: 2015

STREAM: **B.TECH[CSE]** YEAR: **3RD** SEMESTER: **IST** SECTION: **B**

SN	NAME	ROLL NO	Lab_A1(P1,P2,P6, P7,P8)Marks:16	Lab_A2(P3,P4 ,P5)Marks:9	Lab_A3(P 9) Marks:4	Lab_A4(P10, P11,P12) Marks:11	TOTAL[40]
1	RAKESH KUMAR	11900114049	15	8	4	9	**36**
2	RISAB BISWAS	11900114050	14	9	4	11	**38**
3	RISHITA CHOWDHURY	11900114051	14	9	4	11	**38**
4	RIYA MITRA	11900114052	13	9	4	11	**37**
5	RUPAM MITRA	11900114053	7	5	4	8	**24**
6	SACHINKUMARSAHA	11900114054	10	6	4	9	**29**
7	SAGAR BHATTARAI	11900114055	9	6	4	9	**28**
8	SAGARIKA MITRA	11900114056	14	9	4	11	**38**
9	SAHITYA KAUSHIK	11900114057	12	9	4	11	**36**
10	SAMIK ANWAR	11900114058	14	9	4	11	**38**
11	SAMRAT BHATTACHARJEE	11900114059	7	7	2	4	**21**

Hewlett-PackardCOURSE FILE ON DATA STRUCTURE AND

12	SANDIPAN CHAKRABORTY	11900114060	13	8	4	10	**35**
13	SANGAM GURUNG	11900114061	14	9	4	11	**38**
14	SANTANU RAKSHIT	11900114062	13	9	4	11	**37**
15	SAPTARSHI GHOSH	11900114063	13	8	4	11	**36**
16	SAYAN CHAKRABORTY	11900114064	11	8	4	9	**32**
17	SHALINI PRADHAN	11900114065	14	9	4	11	**38**
18	SHALINI ROY CHOWDHURY	11900114066	13	8	4	11	**36**
19	SHASHI KANT PATEL	11900114067	13	9	4	9	**35**
20	SHIRSANA GHATAK	11900114068	11	8	4	9	**32**
21	SNEHA PARIJAAT	11900114069	11	9	4	11	**35**
22	SOHAM SARKAR	11900114070	12	8	4	11	**36**
23	SOURAVENDU NANDY	11900114071	11	8	3	8	**30**
24	SOUVIK BISWAS	11900114072	14	9	4	11	**38**
25	SRIJA GHOSH	11900114073	14	7	4	10	**35**
26	SUBHAM GUHA	11900114074	8	6	3	7	**24**
27	SUBHOJIT KUNDU	11900114075	14	8	4	10	**36**
28	SUDIPTA SAHA	11900114076	11	7	4	10	**32**
29	SURAJ SHARMA	11900114077	13	9	4	9	**35**
30	SURAJIT KUMAR DAS	11900114078	13	9	4	11	**37**
31	SWARNAVA MUKHERJEE	11900114079	14	9	4	11	**38**
32	SWEETY	11900114080	13	8	4	10	**35**
33	UJJAL DAS	11900114081	11	9	4	9	**33**
34	VINITA KUMARI	11900114082	8	6	2	8	**24**
35	ANIRBAN HALDAR	11900114086	8	6	2	6	**22**
36	ADRIJA PAUL(L)	11900115095	11	6	3	9	**29**
37	BINDHYA MANGAN(L)	11900115096	11	6	3	9	**29**
38	POOJA UPADHYAY(L)	11900115097	13	9	4	11	**37**

39	RAJAT MUKHIA(L)	11900115098	13	9	4	10	**36**
40	SHRADHANJALI PRADHAN(L)	11900115099	12	9	4	11	**35**

NAME WITH ROLL NUMBERS OF STUDENT WHOSE ACADEMIC PERFORMANCE IS NOT SATISFACTORY

Sl.	Name of Student	Roll No.	Remedial measures taken by teacher
1	RUPAM MITRA	11900114053	• Additional doubt clearing sessions • Providing extra assignments to students with poor attendance. • Guiding them through previous question papers • Highlighting important and frequently asked questions
2	SACHIN KUMAR SAHA	11900114054	
3	SAMRAT BHATTACHARJEE	11900114059	
4	SANDIPAN CHAKRABORTY	11900114060	
5	SAYAN CHAKRABORTYTY	11900114064	

CERTIFICATE

I, the undersigned, have completed the course allotted to me as shown below

Sl. No.	Semester	Subject with Code	Total Chapters	Remarks
1.	3rd	Data Structure& Algorithm (CS302) Data Structure & Algorithm Lab (CS 392)	10	

Date:	**Signature of Faculty**

Submitted to HOD

Certificate by HOD
I, the undersigned, certify that **Prof. Sutapa Bhattacharya** has completed thecourse work allotted to him satisfactorily / not satisfactorily.

Date :	**Signature of HOD**

Submitted to Director

Date :	**Signature of Director**